

# Molecular Basis of Carbohydrate Biopolymer Structure Determined Digestibility of Newly Developed Warm-Seasoned Corn Lines in Dairy Cows

Ningning Xu<sup>1,2</sup>, Jianxin Liu<sup>2</sup>, Peiqiang Yu<sup>1\*</sup>

<sup>1</sup>Department of Animal and Poultry Science, University of Saskatchewan, 51 Campus Drive, Saskatoon, Canada

<sup>2</sup> Institute of Dairy Science, MoE Key Laboratory of Molecular Animal Nutrition, College of Animal Sciences, Zhejiang University, Hangzhou, 310058, P.R. China

\*Corresponding author: Email: peiqiang.yu@usask.ca

This study intended to detect the molecular basis of carbohydrate (CHO) interaction with rumen and intestinal digestibility in dairy cows using advanced non-destructive molecular spectroscopy. Three newly developed warm-seasoned corn lines (LM10, LM01, and LD999) were used. The CHO molecular structure feature was detected using Attenuated total reflectance Fourier-transform Vibrational Molecular Spectroscopy (ATR-Ft/VMS). The CHO spectral features were revealed with three major peaks: 1<sup>st</sup> peak (ca. 1187-1132 cm<sup>-1</sup>), 2<sup>nd</sup> peak (ca. 1132-1066 cm<sup>-1</sup>) and 3<sup>rd</sup> peak (ca. 1066- 950 cm<sup>-1</sup>). Structure and non-structure CHO spectra were collected at ca. 1287-1213 cm<sup>-1</sup> and ca. 950- 881 cm<sup>-1</sup>. Rumen and intestinal digestibility was determined using fistulated dairy cows. Correlation analysis was applied to reveal relationships between inherent CHO structures and digestion characteristics. Results showed that with advanced ATR-Ft/VMS molecular spectroscopy, the CHO molecular structure make-up and conformation were revealed. Three new lines differed in CHO make-up on a molecular basis. Rumen digestible starch (RDS) was greater in LM01. Total digestible starch (TDS) was greater in LM01 than the other two lines. However, no difference was founded in digestible rumen bypass starch in small intestine. Correlation results showed total CHO and non-structure CHO molecular spectral peak area are positively correlated to starch degradation and digestion ( $P < 0.05$ ). This study demonstrated that the CHO intrinsic molecular structure differences affect CHO rumen and intestinal digestion in dairy cows.